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ABSTRACT

The goal of the Chemical Hygiene Plan (CHP), created by North Seattle Community College, is to provide an environment that protects and promotes health and safety and complies with health and safety laws. The CHP focuses especially on the laboratory workplace (biology and chemistry), as many hazardous materials can be found there. Employee protection measures must be taken, and a Chemical Hygiene Officer must provide training to laboratory workers in order to meet requirements of the Laboratory Safety Standard. Details of the Laboratory Safety Standard are listed. Responsibilities of personnel (such as Chemical Hygiene Administrator and Laboratory Employee) are discussed, along with general rules of laboratory operation (i.e., material handling, waste management, glassware, and inspections). Exposure control measures (i.e., laboratory design and employee exposure protection), employee information and training (training records and emergency procedures), exposure monitoring and medical attention (physician's reports and medical exams), and standard operating procedures (i.e., hazardous materials and distillation) are all described in detail. (CJW)

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ED 452 940

North Seattle Community College
Chemical Hygiene Plan

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Section 2 Responsibilities of Personnel
Section 3 General Rules for Laboratory Operations
Section 4 Exposure Control Measures
Section 5 Employee Information and Training
Section 6 Exposure Monitoring and Medical Attention
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Introduction

I. Goal of the Chemical Hygiene Plan

II. Implementation of the Chemical Hygiene Plan

III. Summary of the Laboratory Safety Standard

I. Goal of the Chemical Hygiene Plan

It is the goal of this college to provide an environment that protects and promotes health and safety and complies with environmental health and safety laws, regulations, and codes. The Chemical Hygiene Plan (CHP) addresses this goal for the laboratory workplace by including the requirements of the Washington Industrial Safety and Health Administration (WISHA) Standard on Occupational Exposure to Hazardous Chemicals in Laboratories (Laboratory Safety Standard— Chapter 296-62-400 WAC). Therefore, the CHP applies to the following groups: Biology and Chemistry.

The Laboratory Safety Standard requires that employers protect workers through the development and implementation of a Chemical Hygiene Plan containing work practices and control measures tailored to limit laboratory workers' exposure to hazardous chemicals regulated by WISHA.

II. Implementation of the Chemical Hygiene Plan

In order to meet the requirements of the Laboratory Safety Standard, the Chemical Hygiene Plan must be crafted to contain specific measures taken to assure employee protection in each laboratory. Faculty and lab supervisors must complete the yellow pages for each laboratory. The Chemical Hygiene Officer, in conjunction with supervisors and faculty, will provide information and training to assure laboratory workers are apprised of the hazards of chemicals present in their work area. This training will occur at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. Refresher information and training will be provided annually.

The Chemical Hygiene Plan for the college will be reviewed by the Chemical Hygiene administrator and the Chemical Hygiene Officer at least annually. The review will look for compliance with appropriate regulations and for adequacy in protecting employees from the health and physical hazards associated with chemicals in use in the laboratory. The results of this review should be recorded, including notes on any changes.

The Plan will be updated as necessary (e.g., when there are changes in laboratory operations, chemical hygiene officer, chemical hygiene administrator, etc.) and in a timely manner.

III. Summary of the Laboratory Safety Standard

The Laboratory Safety Standard can be found in WAC 296-62-400. The standard applies to employers and employees engaged in the laboratory use of hazardous chemicals. To assure laboratory employees are not exposed to WISHA regulated substances in excess of the specified permissible exposure limit, the standard has the following elements:

1. The employer must provide initial and periodic monitoring for any regulated substance if there is reason to believe that a laboratory employee is routinely exposed to any regulated substance above the action level. The employee will be notified of the results within 15 days after the employer receives the results.

2. A Chemical Hygiene Plan, such as this one, must be developed and implemented.

3. Laboratory employees must be provided with information and training concerning the physical and health hazards for the hazardous chemicals they use.

4. The employer must provide employees who work with hazardous chemicals an opportunity to receive medical attention, including follow-up exams when an employee has been exposed, and the employee develops signs and symptoms of exposure, exposure monitoring reveals levels of regulated substances regularly above the action level, or a spill, leak, explosion, or other occurrence resulting in the likelihood of a hazardous exposure.

5. Physical and health hazards are identified through labeling and Material Safety Data Sheets (MSDS').

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Responsibilities

Key Personnel and Their Training

I. Chemical Hygiene Administrator
II. Chemical Hygiene Officer(s)
III. Laboratory Employee
IV. Facilities Maintenance
V. Assigned Personnel

I. Chemical Hygiene Administrator

The Chemical Hygiene Administrator will:

Work with the Chemical Hygiene Officer(s) to develop appropriate policies and practices for the college

Keep the Campus Safety Committee(s) informed of any related issues

Secure and maintain contracts required to fulfill the requirements for exposure monitoring and medical attention

II. Chemical Hygiene Officer(s)

The Chemical Hygiene Officer who is qualified by training or experience will:

Coordinate the MSDS program

Assure adequate records detailing efforts and results of employee exposure monitoring and medical consultations and examinations are maintained

Monitor the legal requirements concerning hazardous substances

Provide technical guidance and information in the development and implementation of the provisions of the Chemical Hygiene Plan

Assure that the Standard Operating Procedures are completed

Chair the Chemical Hygiene Committee

Conduct regular, formal chemical hygiene and housekeeping inspections

Seek ways to improve the chemical hygiene program in the department

Provide laboratory workers with applicable information and training concerning the contents of the Chemical Hygiene Plan in conjunction with the Laboratory Supervisor

Keep the Chemical Hygiene Administrator informed of issues relating to the Chemical Hygiene Plan

Keep Uniform Hazardous Waste Manifests and related documents.

Assure laboratory wastes are properly discarded

III. Laboratory Employee

Each laboratory employee is responsible for:

Planning and conducting each laboratory operation in accordance with the appropriate laboratory procedures and rules outlined in the Chemical Hygiene Plan

Developing good personal chemical hygiene habits

Notifying the laboratory supervisor when an exposure to a hazardous chemical occurs or of unsafe conditions

IV. Facilities Maintenance

Facilities Maintenance assumes responsibility for:

Routinely checking emergency equipment including deluge showers, eye washes, and fire extinguishers

Routinely verifying proper operation of laboratory ventilation and fume hoods

V. Assigned Personnel

Chemical Hygiene Administrator

Name: Tom Griffith Title: Associate Dean

Location: Science/Math Division, IB 2429A

Telephone: (Office)527-3747

Chemical Hygiene Officer

Name:Frank Deering Title: Lab Tech/Science & Math

Location: AS 1527A

Telephone: (Office)527-3751

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General Rules for Laboratory Operations

The following laboratory-specific general safety guidelines aremeant to protect the health and safety of laboratory employeeswho work with hazardous chemicals. Additional laboratory-specificsafety guidelines can be found in the Biology and Chemistry LabSafety Manuals and the NSCC General Lab Safety Manual.

I. General Rules	**II. Chemical Handling**
III. Health and Hygiene	**IV. Food Handling**
V.Housekeeping	**VI.Glassware**
VII.Chemical Procurement	**VIII. Hazard Identification**
IX. Material Handling	**X. Inspections**
XI. Laboratory Operations/Activities Requiring Approval	**XII. Emergency Prevention and Response**
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I. General Rules

A. Know the safety rules and procedures that apply to your work. Before you begin any new operation, determine the potential hazardsand appropriate safety precautions to take.

B. Know the location of and how to use emergency equipment inyour area as well as how to obtain additional help in an emergency. Be familiar with emergency procedures.

C. Know the types of protective equipment that are available,and use the proper equipment for each job.

D. Watch out for unsafe conditions, and call attention to themso that corrections can be made as soon as possible. Someoneelse's accident can be a danger to you as well.

E. Do not smoke in laboratories or areas where chemicals arebeing used or stored.

F. Practical jokes or other behavior, which might distract, startle,or confuse another worker, can be dangerous and must be avoided.

G. Make sure that you use equipment for its designed purposeonly.

H. If you leave an operation unattended for any period of time,leave the laboratory lights on, post a sign, and take the necessaryprecautions in the event of a utility service failure (such ascooling water).

I. Notify your supervisor immediately if you have been exposedto a hazardous chemical.

II. Chemical Handling

A. Do not smell or taste chemicals.

B. Always add strong acids and bases to water. Never add waterto strong acids and bases.

C. Know the hazards posed by the different classes of chemicalsincluding oxidizers, flammables,

corrosives, compressed gasses,and acutely hazardous and chronically hazardous chemicals.

D. Read and understand the Material Safety Data Sheet (MSDS)before using any new chemical.

E. Be aware of the proper waste disposal methods for the chemicalsyou are handling. Improper disposal may lead to injury to humanhealth, the environment, and/or facility equipment.

F. Do not work alone in the laboratory without notifying your supervisor and making arrangements to have someone check in onyou periodically.

G. When transporting, storing, using, or disposing of any substance,be sure that the substance cannot accidentally come into contactwith an incompatible substance. This contact could result inexplosions or the production of highly toxic or flammable substances. Refer to the Incompatibility charts in Appendix A.

H. When chemicals are being transferred from one container toanother, be sure that the new container is compatible with thechemical and is labeled with the name and primary hazard of thechemical.

III. Health and Hygiene

A. Wear appropriate eye protection at all times in areas wherechemicals are used or stored. Do not use contact lenses in thelaboratory.

B. Use protective apparel, including face shields, gloves, andother special clothing as needed. Inspect gloves before eachuse, wash them before removal, and replace them periodically. Avoid contact between gloves and your eyes or mucous membranesduring use.

C. Long hair and loose clothing should be confined to avoid accidents. Sandals, cloth sneakers, and perforated shoes should not be worn.

D. Do not use mouth suction to pipette chemicals or to starta siphon; a pipette bulb or aspirator should be used to providevacuum.

E. Avoid exposure to gases, vapors, and aerosols. Use appropriatesafety equipment when this type of exposure is likely.

F. Wash well before leaving the laboratory.

IV. Food Handling

A. No food or beverages should be stored, handled, or consumedin the laboratory or other areas where chemicals are used or stored.

B. Do not bring chemicals or chemical equipment into areas thatare designated for food consumption or smoking.

C. Glassware or utensils that have been used for laboratory operationsshould never be used to prepare or consume food. Laboratory refrigerators,ice chests, microwave ovens, cold rooms, etc. must not be usedfor food storage.

V. Housekeeping

A. Work areas should be kept clean and free from obstructions. Clean-up should follow the

completion of each operation or atthe end of each day.

B. Wastes should be deposited in the appropriate receptacles. Equipment and chemicals should be stored properly and cluttershould be stored properly, and clutter should be minimized.

C. Laboratory accidents and spills should be attended to immediately. Follow the appropriate emergency procedures.

D. Chemical and waste containers should be kept labeled at alltimes. Your supervisor should be informed immediately of thepresence of any unlabeled containers. Do not open unlabeled containers.

E. Access to exits, emergency equipment, controls, etc. shouldnot be blocked.

F. Notify your supervisor immediately if equipment is malfunctioning. Discontinue use of the equipment if a safety hazard exists.

G. Chemical stored under the hoods should be kept to a minimum. Leave the hood on when it is not in use if chemicals are storedthere.

VI. Glassware

A. Accidents involving glassware are the leading cause of laboratoryinjuries. Careful storage and handling procedures should be usedto avoid glassware breakage.

B. Adequate hand protection should be used when inserting glasstubing into rubber stoppers or corks or when placing rubber tubingon glass hose connections. Tubing should be fire polished orrounded and lubricated, and hands should be held close togetherto limit movement of glass should a fracture occur.

C. Vacuum-jacketed glass apparatus should be handled with extremecare to prevent implosions. Only glassware designed for vacuumwork should be used for that purpose.

D. Hand protection should be worn when picking up broken glass. Small pieces should be swept up with a brush and dust pan.

VII. Chemical Procurement

It is the policy of NSCC to require an approved Standard OperatingProcedure (SOP) for each hazardous chemical used or stored oncampus. The following procedures should be followed by all campuspersonnel who are involved in the procurement of hazardous chemicals:

A. Purchase Approval

1. The Chemical Hygiene Officer should approve the purchaseof any *new* hazardous chemicals with an NFPA rating of 3or greater.

Purchaser should submit a copy of the SOP (see Section 7)for use of the hazardous chemical and a copy of the MSDS to theC.H.O.

In most cases, 24 hours written notice should be sufficientbut, in the case of particularly hazardous materials or specialprecautions, additional time may be required.

2. The departmental Chemical Hygiene Committee member shouldoversee the purchase of all

subsequent purchases of chemicals.

3. Purchase review should include, but not be limited to, adetermination of adequacy of the SOP, availability of MSDS', andappropriateness of quantity of chemical ordered. (It is prudentpractice not to order more than a one-year supply at any one time.)

B. Receiving Shipments

1. Before a substance is received, information on proper handling,storage, and disposal should be available to employees involvedin receiving and distribution of hazardous chemicals. This informationis provided in the SOP and the MSDS.

2. Preferably, all substances should be received at the centralreceiving location at the college.

3. Any damaged container of hazardous chemicals should be reportedto the Chemical Hygiene Officer.

C. Distribution

1. *No container should be released without an identifyinglabel and MSDS (2 copies).*

Note: One copy of the MSDS should be sent to the Chemical HygieneOfficer and the second copy for the Purchaser to be deliveredwith the chemical.

2. When chemicals are hand carried, the container should beplaced in a container or bucket to protect against spillage orbreakage.

3. Peroxidzable chemicals must be dated when opened. Thesemust be used within one year or disposed of within that time.

D. Peroxidizable Chemicals

A variety of chemicals can form highly explosive peroxide compoundsas impurities when exposed to air over a period of time. Thisproblem is most common in ethers but also occurs in a varietyof other organic compounds as well as in some alkali metals andamides. A number of severe laboratory explosions have occurredas a result of handling old diethyl ether and diisopropyl ether. As a result, great care must be taken to prevent the formationof peroxides in these chemicals.

Preventing the formation of peroxides is dependent on carefulinventory control of peroxidizable chemicals. Most peroxidizablechemicals are sold commercially with inhibitors to prevent peroxixdeformation. These are effective until the container is first opened. After a container is opened, the chemical comes in contact withair and may begin to form peroxides. Therefore, there are twosteps to prevent the hazards of peroxide formation in peroxidizablecompounnds:

1. Date all containers of the peroxidizable chemicalslisted below with the date on which the bottle was first opened,and

2. Discard all containers exceeding the time limitationslisted below:

Severe Peroxide Hazard ***discard within 3 months***

1. Diisopropyl ether

2. Divinylacetylene4

3. Potassium metal

4. Potassium amide

5. Sodium amide

6. Vinylidene dichloride (1, 1-dichloroethylene)4

*High Peroxide Hazard**discard within 6 months***

1. Cumene

2. Cyclohexene

3. Cyclopentene

4. Diethyl ether

5. Dioxane

6. Ethylene glycol ethers (cellosolves and glymes)

7. Furan

8. Methyl isobutyl ketone

9. Tetrahydrofuran

10. Vinyl ethers4

This is by no means a comprehensive list. Manufacturers willoften state hazard warnings on peroxidizable chemicals. Theseshould be dated and discarded within the time limitations suggestedby the manufacturer.

E. Picric Acid and Other Polnitroaromatic Compounds

Polynitroaromatic compounds are commonly used in laboratoriesand are relatively safe in the form in which it is sold. Theyare ordinarily sold with 3 to 10 percent water added to stabilizethem. However, they will become unstable when they are allowedto dry out. additionally, picric acid will become explosive ifit is allowed to form a metal salt. The following steps shouldbe taken to safely store these chemicals:

1. Never allow picric acid to be stored in containers with metalcaps or to come in contact with any metal.

2. Weigh polynitroaromatic compounds when they are receivedfrom the manufacturer. Keep a record of the compound's weightbefore and after each use. The difference between the weightbefore its use and the weight after the last use is probably dueto water evaporation. Carefully, add water, if needed.

3. Polynitroaromatic compounds should never be opened when theyare old or very dry. Contact the hazardous waste program staffif you encounter a polynitroaromatic compound in this condition.

F. Tollen's Reagent

Tollen's reagent (ammoniacal silver nitrate) has caused severallaboratory explosions when not discarded immediately after use. The reagent can form highly explosive silver fulminate over timeafter it has been used. To avoid this problem, add diluted nitricacid to Tollen's reagent immediately after use, and dispose ofthe solution through the hazardous waste program.

G. Sodium Azide

Sodium azide, although not inherently unstable, may form highlyexplosive heavy metal azides if contaminated or used improperly. Disposal of sodium azide solutions to the sewer may cause theformation of lead or copper azide in plumbing. Several seriousexplosions have occurred as a result of routine improper disposalof sodium azide. Care should also be taken that sodium azideis not heated rapidly or stored in containers with metal components.

H. Nitrocellulose Paper and Tubes

Several nitrocellulose products, primarily paper and tubes,are used in some laboratories. Nitrocellulose burns vigorouslyin ambient conditions and may explode when heated under confinement. As a result, these products should never be autoclaved as a meansof decontamination.

VIII. Hazard Identification

Laboratory chemicals and facilities should be properly labeledto identify any hazards associated with them for employee informationand protection.

A. Container Labels

1. Labels on incoming containers of hazardous chemicals mustnot be removed or defaced. When dispensing chemicals from onecontainer to another, make sure that the new container is properlylabeled with the chemical name and hazards. All secondary containersshould be labeled in this manner unless they are intended forthe immediate use of the person who dispensed the chemicals.

2. Unlabeled bottles of chemicals should not be opened; suchmaterials should be disposed of promptly as outlined in the WasteDisposal Procedures, Part XII.

B. Material Safety Data Sheets

1. Material Safety Data Sheets received with incoming shipmentsof hazardous chemicals must be maintained and made readily availableto laboratory employees.

2. A Material Safety Data Sheet (MSDS) is a major source ofinformation on the hazards of the chemicals we work with. Manufacturersand importers must develop an MSDS for each hazardous chemicalthey produce or import. An MSDS must be obtained and managedby the Chemical Hygiene Committee representative from each divisionfor each hazardous chemical in the facility. These MSDS' canbe readily viewed upon request to the Chemical Hygiene Committee. The form of the MSDS is not always the same, but all MSDS' containinformation on potential physical and health hazards. AppendixB explains the information contained within MSDS.

3. MSDS' are required for all hazardous chemicals as definedby WAC 296-62-05421, Appendix A and B. See *Understanding Rightto Know*, Appendix I. The Chemical Hygiene Committee representativeof each area must make sure to:

Keep MSDS' received for hazardous chemicals, making sure theyare accessible to employees during each work shift and obtainingan MSDS for a hazardous chemical upon request of an employee. Copies of MSDS' of all hazardous materials stored on the campusare also available in the MSDS reference station located in thehallway behind room 1519 in the Science Lab Building.

Ensure that any container of hazardous chemicals leaving thearea are labeled correctly and that a MSDS is provided as requiredby WAC 296-62-05403(3)(d). See Appendix I.

C. Common Chemicals and Chemical Classes

1. Solvents

Alkanes and Petroleum Solvent Mixtures

Properties: Flammable or combustible, depending on molecularweight. Relatively low toxicity, with a few exceptions.

Examples: Hexane, Heptane, Paint Thinner, Stoddard Solvent

Aromatic Solvents

Properties: Flammable. Moderate toxicity. Benzene is a carcinogen.

Examples: Benzene, Toluene, Xylene, Pseudocumene

Alcohols

Properties: Flammable. Low toxicity.

Examples: Methanol, Ethanol, Isopropanol

Nitriles

Properties: Flammable, moderate to high toxicity.

Examples: Acetonitrile

Ethers

Properties: High flammable. Generally low toxicity. p-Dioxaneis a carcinogen. All form unstable organic peroxides over time.

Examples: Diethyl ether, Tetrahydrofuran, p-Dioxane

Chlorinated Solvents

Properties: Generally nonflammable. Moderate to high toxicity. Chloroform is a carcinogen.

Examples: Methylene Chloride, Chloroform, Trichloroethylene,1,1,1-Trichloroethane

2. Oxidizers

Properties: Variable toxicity, usually related to the metal. React violently with solvents, metals, and other reducing agents. Some are explosive, especially hydrogen peroxide over 30%, certainmetal perchlorates, and peroxides.

Examples: Nitric Acid, Perchloric Acid, Chromic Acid (chromiumtrioxide/sulfuric acid), Hydrogen peroxide, Osmium Tetroxide,Various Metal Saltschromates, dichromates, perchlorates, peroxides,permanganates, persulfates

3. Corrosive Materials

Inorganic Acids (non-oxidizing)

Properties: Very corrosive.

Examples: Sulfuric Acid, Hydrochloric Acid, HydrofluoricAcid, Phosphoric Acid

Organic Acids

Properties: Moderately strong to weak acids. Low molecularweight organic acids are very corrosive in concentrated form. Higher molecular weight organic acids are much less corrosive.

Examples: Formic Acid, Acetic Acid, Propionic Acid

Inorganic Bases

Properties: Moderate to strong bases, weak to very highlycorrosive.

Examples: Metal Hydroxides (e.g., sodium hydrozide, potassiumhydroxide), Metal Carbonates, Ammonia

Organic Bases

Properties: Low molecular weight amines are very strong bases;pH and corrosivity decrease with increasing molecular weight.

Examples: Aliphatic Amines (methyl amine, triethylamine),Quaternary Ammonium Hydroxide Compounds (e.g., tetramethyl ammoniumhydroxide)

4. Poisons, Carcinogens, Mutagens, Etc.

Toxic Metals

Arsenic: Highly toxic; some salts are carcinogenic.

Barium: Moderate to low toxicity; regulated due to environmentaleffects

Beryllium: Highly toxic, especially as the metal powder;metal powder is carcinogenic

Cadmium: Highly toxic; some salts are carcinogenic

Chromium: Moderately toxic; hexavalent chromium salts arecarcinogenic

Lead: Moderately to highly toxic; some salts are carcinogenic

Mercury: Salts and organomercury compounds are highly toxic;metallic mercury is quite toxic by inhalation

Nickel: Moderately toxic; metal powder and some salts arecarcinogenic

Osmium: Osmium tetroxide is highly toxic; toxicity of osmiumsalts is not very clear

Selenium: Moderately to highly toxic

Silver: Low to moderate toxicity; regulated due to environmentaleffects

Thallium: Highly toxic

Tin: Organotin compounds are moderately to highly toxic

Zinc: Low to moderate toxicity

Cyanides and Sulfides (Inorganic)

Properties: Highly toxic; form poisonous gas (hydrogen cyanideand hydrogen sulfide) when they come in contact with acids.

Examples: Sodium Cyanide, Sodium Sulfide, Cyanogen Bromide

Miscellaneous

Phenol: Highly toxic; causes severe skin burns.

Formaldehyde: Highly toxic, especially by inhalation; causessensitization in some individuals; strongly suspected to be ahuman carcinogen

3,3'-Diaminobenzidine: Potent mutagen

Ethidium Bromide: Similar properties to 3,3'-Diaminobenzidine

Acrylamide: Neurotoxic

5. Reactive Chemicals

Explosive Compounds

Whether or not a compound is explosive depends on a numberof factors. Many chemicals are potentially explosive compoundsbut are sold and used in a stabilized form. Common classes ofexplosive compounds are listed below:

Polynitroaromatic Compounds: These are solid materials whichbecome shock sensitive when dry. Examples include picric acid,trinitrotolune (TNT), trinitrobenzene, picryl chloride, picrylsulfonic acid.

Polynitroalkyl Compounds: These are generally liquids which maybe shock sensitive. Examples include tetranitromethane, trinitromethane.

Nitrocellulose: Can be unstable when dry, especially when heated.

Organic Peroxides

Commercial organic peroxides are relatively stable in ordinarystorage conditions but can become explosive at elevated temperaturesand when old or contaminated.

Examples: Benzoyl Peroxide, Di-t-butyl Peroxide, t-Butyl Hydroperoxide,Methyl Ethyl Ketone Peroxide

Peroxidizable and Polymerizable Compounds

Certain organic compounds tend to form unstable organic peroxidecompounds over time. Others form trace amounts of organic peroxideswhich can catalyze violent polymerization.

Examples: Ethersdiethyl ether, tetrahydrofuran, isopropyl ether,p-dioxane; Unsaturated Compounds1,1-Dichloroethylene, cyclopentadiene;Miscellaneouscumene, styrene, acrolein, methylcyclopentane

IX. Material Handling

The storage, distribution, and methods of handling hazardous chemicalswill be conducted in a manner which minimizes the potential foraccidents and employee exposure.

A. Stockrooms/Storerooms

Hazardous chemicals should be segregated in a well-identifiedarea with local exhaust ventilation. Stockrooms/storerooms shouldbe under the control of one person who is responsible for itssafety and inventory control. Stored chemicals should be examinedat least annually for replacement, deterioration, and containerintegrity.

B. Laboratory Storage

Quantities of chemicals stored in the laboratory should be keptto a minimum. Chemicals should be stored away from heat sourcesand direct sunlight. Periodic inventories should be conductedwith unnecessary items being returned to the storeroom/stockroom.

Incompatible materials should be segregated for storage. Referto the Incompatibility Charts in Appendix A.

1. Hazardous chemicals should be segregated in a well-identifiedarea and, whenever practical, chemicals should be stored in ventedcabinets. Chemical storage on bench tops is inadvisable.

2. Highly hazardous chemicals should be stored in secondarycontainers that are chemically-resistant and unbreakable.

3. Stored chemicals should be examined periodically (at leastannually) for deterioration, container integrity, or possiblereplacement.

4. The amount of chemicals permitted for storage should be assmall as practical.

5. Fume hoods are not intended for the storage of chemicals. The newer two-speed fume hoods are designed to provide adequateair velocity for temporary storage of small amounts of chemicals. Chemicals stored in fume hoods should be kept to a minimum andshould not block vents or alter airflow patterns.

6. Earthquakes do occur in Seattle; therefore, chemical storagemethods should be planned accordingly. If possible, all shelvesshould be securely anchored to walls, fitted with lipped edgesand enclosed with latched doors. Heavy objects should be storedon lower shelves.

C. Laboratory Signs

1. Laboratory areas that have special or unusual hazards (e.g.,radiation areas, designated areas) should be posted with warningsigns.

2. Signs should be posted to show the location of safety showers,eyewash stations, exits, first aid kits, fire extinguishers, etc. Extinguishers should be labeled to show the type of fire forwhich they are intended. Waste containers should be labeled toshow the type of waste that can be safely deposited.

3. Consumption of food and beverages is not permitted in areaswhere laboratory operations are being carried out. areas wherefood is permitted should be marked, and a warning sign (e.g.,*Eating Area; No Chemicals)* should be posted.

D. Use of a Hood

1. A hood should be used for operations which might result inrelease of toxic chemical vapors or dust. In general, the hoodshould be used when working with any appreciably volatile substancewith a TLV of less than 50 ppm.

2. Storage of chemicals in the hood should not be allowed toblock vents or air flow and should be kept to a minimum. Thehood should be kept on if chemicals are stored there.

E. Dispensing Chemicals

1. When chemicals are being transferred from one container toanother, employees should be sure that the new container is compatiblewith the chemical.

2. The container must be labeled with the chemical name andhazard warnings, including target organ effects, if applicable. The only exception is when the chemical will be used by an individualwithin their work shift.

3. The Hazardous Materials Information System (HMIS) is commerciallyavailable labeling system that uses color coding and numeric ratings. When the HMIS system is used, all laboratory employees will receivetraining on reading and using the system.

X. Inspections

General safety inspections of the laboratory will contribute tooverall laboratory and employee safety. The Area Supervisor,Chemical Hygiene Officer. and physical plant employees will inspectlaboratories for the following:

A. Area Supervisor

1. Personal protective equipment

2. Spill kits

3. Eye washes

4. General laboratory hygiene

5. First aid kit

6. Adequate training of students and employees

B. Chemical Hygiene Officer

1. Verify that area-specific sections of the Chemical HygienePlan are complete and adequate.

2. Availability of MSDS and the CHP

3. Storage of hazardous chemicals

4. Emergency response plans

C. Physical Plant Employee

1. Fumehoods and other ventilation equipment

2. Emergency equipment including fire extinguishers and safetyshowers

3. Egress signage and other safety signage

XI. Laboratory Operations/Activities Requiring Approval

Employees should be informed of those laboratory procedures andoperations which require prior approval from the Chemical HygieneOfficer to ensure that these activities are carefully monitoredfor adherence to the Chemical Hygiene Plan and regulatory requirements.

A. Laboratory Operations Requiring Prior Approval

1. Non-routine hazardous chemical procedures for which the employeehas not been trained.

2. Analytical work with an unknown substance.

3. Operations or activities for which there are no written procedures.

4. Procurement of hazardous chemicals. See Section 7, Page3.4.

XII. Emergency Prevention and Response

Laboratory employees should be familiar with emergency response,first-aid, and accident reporting procedures in the campus safetyplan in order to prevent and reduce the impact of laboratory accidents.

A. Safety Equipment

This section contains a general list of types of safety equipmentfound in laboratories, including information on use and maintenance.

1. Eyewash Stations

Flush the eyewash stations in your laboratory at leastweekly. Eyewash stations should provide a soft stream or sprayof water no less than 1.5 liters per minute for at least 15 minutes. (Policy Reference, WAC 296-62-130).

Laboratory personnel must be able to reach eyewash stationswithin ten seconds (Policy Reference, WAC 296-62-130).

Because chemical splashes to the eyes may impair vision, laboratoryworkers should memorize the location and usage of all eyewashstations in their area.

When used, flush eye for at least 15 minutes holding eyelidopen. Prompt medical attention is important regardless of theseverity of the injury.

2. Emergency Showers

Safety showers are tested by maintenance personnel to ensurethe valve is operating, that all debris is removed from the system,and that safety showers have sufficient flow of water (no lessthan 30 gallons per minute). (Policy Reference, WAC 296-62-130).

Laboratory personnel must be able to reach showers withinten seconds. (Policy Reference, WAC 296-62-130).

Every laboratory worker should know how to use the safetyshowers and the location of them in their area.

When used, remove contaminated apparel, flush area for 15minutes, and obtain medical attention.

3. Laboratory Spill Kits

All laboratories should have spill clean-up materials availableeither by purchasing commercially available spill kits or by assemblingyour own spill kit materials. Caustic and solvent commercialspill kits are designed typically for 1 liter spills.

Spill kits should include the following items:

diatomaceons earth 5 gallon pail

absorbent pillows or pads apron

mercury absorbent sponge broom/whisk

spill-x multipurpose spill kit goggles

citric acid gloves

sodium bicarbonate disposable coveralls

plastic bags (zip lock)

XIII. Waste Management

The Chemical Hygiene Officer will ensure that laboratory chemicalsare disposed of in compliance with appropriate regulations andin a manner which minimizes damage to human health and the environment.

A. Waste Handling

1. Chemical wastes should be removed from the laboratory to a central waste storage area, by authorized personnel, at least once a week and from the central storage area at regular intervals. Unlabeled containers of chemicals and solutions should undergo prompt disposal; if partially used, they should not be opened. Refer to the List of Potentially Incompatible Chemicals in AppendixA.

B. Waste Disposal/Recycling

1. Laboratory wastes should be recycled whenever possible. Before disposing of any laboratory waste materials, consult theChemical Hygiene Officer for the proper disposal method or procedure. Hoods should not be used as a waste disposal for volatile chemicals.

2. Additional waste disposal information can be found in theStandard Operating Procedures and in the Material Safety DataSheets.

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Exposure Control measures

I. Laboratory Design
II. Laboratory Hood Inspection Report, Part A
III. Laboratory Hood Inspection Report, Part B
IV.Employee Exposure Protection (PPE)
V. Criteria for Specific Exposure Control Measures
VI. Procedures for Handling Reproductive Toxins
VII.Procedures for Handling Chemicals with high Acute Toxicity
VIII. Procedures for Handling Select Carcinogens

Laboratory Facilities (Design Criteria)

The work conducted in a lab and its scale must be appropriate to the physical facilities available and to the quality of the ventilation system. Laboratory facilities should be designed in compliance with state and federal regulations.

I. Laboratory Design

A. A laboratory facility should include, where appropriate:

1. An adequate general ventilation system with air intakes and exhausts located so as to avoid intake of contaminated air.

2. Well-ventilated stockrooms and storerooms.

proper chemical storage for specific hazardous materials (e.g., flammables, corrosives, poisons, etc.)

adequate laboratory hoods and sinks

emergency equipment including fire extinguishers, spill kits, and alarms

first-aid equipment including first-aid kits, eyewash fountains and drench showers

no direct drainage to sewers (storm drains, domestic sewage systems, etc.)

arrangements for proper waste disposal

B. Laboratory Ventilation

1. The general laboratory ventilation system should:

provide a source of air for breathing and for input to local ventilation devices

ensure that laboratory air is continually circulated

direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building

General laboratory ventilation should not be relied on for protection from exposure to hazardous chemicals released into the laboratory. A rate of 4 to 12 room air changes per hour is normally adequate general ventilation if local exhaust systems, such as hoods, are used as the primary method

of control. General air flow should not be turbulent and should be relatively uniform throughout the laboratory.

2. A laboratory hood with a minimum of 2.5 linear feet of hood space per person should be provided. Airflow into and within the hood should not be excessively turbulent, and hood face velocity should be adequate (typically 60 - 125 lfm). Laboratory hoods should be inspected annually to determine velocities and equipment integrity. (See Inspector Report on page 4.3)

3. Hazardous chemicals stored in cabinets should be fitted with auxiliary ventilation systems. Stockrooms should be well ventilated.

4. The quality and quantity of ventilation should be evaluated on installation, regularly monitored (at least every six months), and re-evaluated whenever a change in ventilation devices is made.

Laboratory Hood Inspection Report, Part A

Hood Number:

Location:

Design Specifications and Test Parameters:

Average Face Velocity:

Optimum Face Velocity:

Hood Face Opening:

Total exhaust Air Volume:

Test Results:

Test Date	
Avg. Face Vel.	
Optimum Face Vel.	
Total Exh air Vol.	

Date	Inspection and Test Notes	Action Taken*	Initials

*Use back of page if additional space is needed.

Laboratory Hood Inspection Report, Part B

Hood Number:

Location:

Date	Chemical Storage in Hood	Leaking Containers	Opening Clear	Other

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

Employee Exposure Protection

Laboratory operations will be conducted in a manner that prevents employee exposure to WISHA regulated substances in excess of the permissible exposure limits (PELs) specified in chapter 296-62-750 WAC. A list of WISHA regulated chemicals and their PELs is provided in Appendix G. Additional information is available in MSDS' and Standard Operating Procedures.

I. Respiratory Equipment

Proper respiratory equipment will be provided to employees where the use of respirators is necessary to maintain exposure below permissible exposure limits. Respirators will be selected and used in accordance with Chapter 296-24-071 of the Washington Administrative Code.

II. Personal Protective Equipment

Personnel using personal protective equipment must have proper training. An overview of the types and classifications of various personal protective equipment is provided in Appendix D (OSHA Booklet #3077).

Criteria for Specific Exposure Control Measures

The criteria for determining when and what types of specific exposure control measures should be implemented will be based on the degree of toxicity of each type of substance:

I. Select Carcinogens

A. It is regulated by WISHA as a carcinogen, or

B. It is listed under the category *known to be carcinogens* in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition, or

C. It is listed under Group 1 (*carcinogenic to humans*) by the International Agency for Research on Cancer Monographs (IARC) (latest edition), or

D. It is listed in either Group 2A or 2B by IARC or under the category *reasonably anticipated to be carcinogens* by NTR and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria

1. After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m3

2. After repeated skin application of less than 300 mg/kg of body weight per week

3. After oral dosages of less than 50 mg/kg of body weight per day

E. A listing of IARC Group 1, 2A, and 2B chemicals, as well as the NTP carcinogens, are included in Appendix E.

II. Reproductive Toxins

A. Affect the reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis)

B. Cause infertility in females or males

C. *California* list of carcinogens and reproductive toxins are listed in Appendix E.

III. High Acute Toxicity Substances

A. May be fatal or cause damage to target organs as a result of a single exposure

B. Examples include hydrogen cyanide, hydrogen sulfide, and nitrogen dioxide.

Procedures for Handling Reproductive Toxins

Examples: Lead Compounds, Organomercurials, Gormamide Ethidium Bromide

A. Women of child bearing age should only handle these substances in a hood whose satisfactory performance has been confirmed.

B. Avoid skin contact by using gloves and wearing long sleeves and other protective apparel as appropriate.

C. Always wash hands and arms immediately after working with these materials.

D. Keep records of the amounts of these materials on hand, amounts used, and the names of the workers involved.

E. Employees should be familiar with the emergency procedures for accidents or spills involving these substances. The Chemical Hygiene Officer should be notified of all incidents of exposure or spills.

F. Unbreakable containers of these substances should be stored in a well-ventilated area and should be labeled properly.

Procedures for Handling Chemicals with High Acute Toxicity

Examples: Hydrofluoric Acid, Hydrogen Cyanide

A. Use and store these substances in areas of restricted access with special warning signs.

B. Always use a hood or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance. The released vapors should be trapped to prevent their discharge with the hood exhaust.

C. Avoid skin contact by using gloves and wearing long sleeves and other protective apparel as appropriate.

D. Always wash hands and arms immediately after working with these materials.

E. Keep records of the amounts of these materials on hand, amounts used, and the names of the workers involved.

F. Employees should be familiar with the emergency procedures for accidents or spills involving these substances. If a major spill occurs outside of the hood, emergency responders should wear appropriate personal protective equipment, and all other workers should evacuate the area.

G. Be sure that at least two people are present at all times when a highly toxic compound, or compound of unknown toxicity, is being used.

H. Breakable containers of these substances should be stored in resistant trays, and work and storage surfaces should be covered with removable, absorbent plastic-backed paper.

I. Contaminated clothing should be chemically decontaminated, if possible, or destroyed. Contaminated waste should be stored in suitably labeled impervious containers. Liquid can be stored in glass or plastic bottles containing vermiculite.

Procedures for Handling Select Carcinogens

Examples: Benzene, Nickel, Vinyl Chloride

A. All work with these substances should be conducted in a *designated area* such as a restricted access hood, glove box, or portion of a lab designated for use of chronically toxic substances. People with access to this area should be aware of the substances used and the necessary precautions to take. The designated area should be clearly marked with warning and restricted access signs.

B. The use and disposal of these substances should be approved by the Chemical Hygiene Officer prior to this activity.

C. Always use a hood or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance. The released vapors should be trapped to prevent their discharge with the hood exhaust.

D. Vacuum pumps should be protected against contamination by scrubbers or other devices and vented into the hood. Vacuum pumps and other contaminated equipment should be decontaminated in the hood prior to removing them from the designated area. The designated area should also be decontaminated before resuming work there.

E. Avoid skin contact by using gloves and wearing long sleeves and other protective apparel as appropriate.

F. Remove any protective clothing before leaving a designated area, and place it in an appropriate, labeled container.

G. Always wash hands, arms, face, and neck immediately after working with these materials.

H. Keep records of the amounts of these materials on hand, amounts and dates used, and the names of

the employees involved.

I. Employees should be familiar with the emergency procedures for accidents or spills involving these substances. If a major spill occurs outside the hood, emergency responders should wear appropriate personal protective equipment, and all other workers should evacuate the area.

J. Be sure that at least two people are present at all times when a highly toxic compound, or compound of unknown toxicity, is being used.

K. These substances should be stored in unbreakable containers in a ventilated area with limited access. Work and storage surfaces should be covered with removable, absorbent plastic-backed paper. All containers should be labeled with the identity and hazards of the substance.

L. Contaminated clothing should be chemically decontaminated, if possible, or destroyed. Contaminated waste should be stored in suitably labeled impervious containers. Liquids can be stored in glass or plastic bottles containing vermiculite. Containers of contaminated wastes should be transferred from the designated area in a secondary container.

M. Positive pressure glove boxes should be checked for leaks before each use. Negative pressure glove boxes should have a ventilation rate of at least 2 volume per hour and a pressure of at least 0.5 inches of water. Exit gases should be trapped or filtered and then released through the hood.

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Employee Information and Training

I. Information and Training

II.Employee Training Program

III. Employee Training Record

I. Information and Training The Chemical Hygiene Officer will assure laboratory and other appropriate employees (e.g., receiving and shipping personnel, custodial, maintenance, stockroom personnel, emergency teams) are provided with information and training on the hazards of chemicals present in their work area and what to do if an accident occurs.

I. Training Program

Training will consist of at least the following subjects:

A. Methods that may be used (including observations) to detect the release or presence of a hazardous chemical (such as continuous monitoring devices and the visual appearance or odor of hazardous chemicals when being released).

B. The physical and health hazards of chemicals in the work area.

C. The measures employees can take to protect themselves from these hazards including specific procedures that this college has implemented to protect employees from exposure to hazardous chemicals (e.g., General Laboratory Safety Rules, emergency procedures, and protective equipment to be used).

II. Information for Employees

Employees will be provided with the following information:

A. The WISHA Standard for Occupational Exposure to Hazardous Chemicals in Laboratories and its Appendices (Appendix F).

B. The location and availability of the Chemical Hygiene Plan.

C. The permissible exposure limits (PELs) for WISHA regulated substances (Appendix G) or recommended exposure limits for other hazardous chemicals where there is no applicable standard.

D. The signs and symptoms associated with exposure to hazardous chemicals used in the laboratory (Appendix H).

E. The location and availability of reference material on the hazards, safe handling, storage, and disposal of hazardous chemicals found in the laboratory, including Material Safety Data Sheets.

III. When to Provide Training and Information

A. Information and training will be provided at the time of the employee's initial assignment to the work area where hazardous chemicals are present and prior to assignments involving new exposure situations. Refresher information and training will be provided at least annually.

B. Use the following Employee Training Program and thc Laboratory Employee Training Record to provide an overview of training requirements and document employee participation, respectively.

Employee Training Program Laboratory employees will be trained on the applicable details of the Chemical Hygiene Plan (CHP) including a review of the:

A. General Rules for Laboratory Safety (Section 3).

B. Appropriate Areas of the Laboratory Operations Section (Section 3).

1. Laboratory Operations/Activities requiring Approval

2. Material Handling (including dispensing and labeling of chemicals)

3. Waste Disposal Methods

4. Chemical Hygiene Personnel (Section 2)

C. Emergency procedures as outlined in the Campus Safety Plan including spills, fires, explosions, evacuation, and decontamination.

D. Exposure control measures to be used in handling particularly hazardous chemicals (Section 4).

WISHA requires that the training also address:

A. Methods and observations that can be used to detect the presence or release of a hazardous chemical (including any monitoring being conducted and the visual appearance or odor of a chemical when released).

B. The physical and health hazards of chemicals in the work area (SOPs and MSDS').

C. Measures employees can take to protect themselves from these hazards including the location and proper use of protective apparel and equipment and the location of emergency equipment and exits (Section 4 and Appendix C).

Laboratory Employee Training Record

Laboratory Employee Training Record

Employee Name:

Employee ID No.

Date:

Training Requirement: Occupational Exposure to Hazardous Chemicals in Laboratories
Chapter 296-62-400 WAC
Chemical Hygiene Plan

The following information was covered in the training session:

General Laboratory Safety Rules (Section 3)

Laboratory Operations or Activities Requiring Approval (Section 3)

Procedures for Handling and Labeling of Chemicals and Working Alone (Section 3)

Identity of Chemical Hygiene Personnel (Section 2)

Emergency Procedures (Campus Safety Plan)

Exposure Control Measures (Section 4)

Methods and Observations to Detect the Presence or Release of a Hazardous Chemical (Monitoring and/or Visual Appearance or Odor)

Physical and Health Hazards of Chemicals in the work Area (SOPs and MSDS')

Measures to Protect Yourself from the Hazards Posed by Chemicals in the Lab (Section 4 and Appendix D)

Proper Waste Disposal Methods (Section 3)

Other _____

Employee's Signature: Date:

Trainer's Signature: Date:

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Section 6: Exposure Monitoring and Medical Attention

I. Exposure Monitoring

II. Medical Consultations and Exams

III. Laboratory Employee Medical Report
(Information for the physician/physician/s report)

I. Exposure Monitoring

If there is reason to believe that exposure levels for a WISHA regulated substance routinely exceed the action level (or, in the absence of an action level, the PEL), employee exposure to that substance will be measured.

I. Initial Exposure Determination

Factors that might raise the possibility of over-exposure and, therefore, warrant an initial measurement of employee exposure include:

A. The manner in which the chemical procedures or operations involving the particular substance are conducted (e.g., use of an open vessel instead of a closed system).

B. The existence of historical monitoring data which shows elevated exposures to the particular substance for similar operations.

C. The use of a procedure which involves significant quantities or is performed over an extended period of time.

D. Signs or symptoms of exposure (e.g., skin or eye irritation, shortness of breath, nausea, headache, etc.) which are experienced by the employee.

II. Exposure Monitoring

If the initial exposure determination described above discloses employee exposure over the action level for a particular substance (or, in the absence of an action level, the PEL), the college will immediately comply with the exposure monitoring requirements of the WISHA standard for that substance. Appendix G contains the PELs for WISHA regulated substances.

Monitoring airborne concentrations of individual hazardous chemicals should be conducted in the following circumstances:

A. In testing or re-designing the hoods and other local ventilation devices in the laboratory.

B. When a specific substance that is highly toxic is regularly and continuously used (e.g., three times a week).

C. When requested by a laboratory employee because of a documented health concern or suspicion that a PEL may be exceeded.

III. Recordkeeping

A. Exposure testing procedures and results should be sent to the individual designated by the Chemical Hygiene Officer who coordinates and maintains these records.

B. The employee will be notified of any monitoring results within 15 working days after receipt of the results either individually or by posting the results in an appropriate location that is accessible to employees.

C. An accurate record of any measurements taken to monitor employee exposures must be kept, transferred, and made available for each employee in accordance with WISHA's Access to Employee Exposure and Medical Records requirements (Chapter 296-62-052 WAC).

II. Medical Consultations and Medical Exams

Employees who work with hazardous chemicals will be provided with an opportunity to receive medical attention when over-exposure to a hazardous chemical is suspected.

I. Medical Attention will be Provided to an Employee Under the Following Circumstances:

A. Whenever an employee develops signs or symptoms of exposure to a hazardous chemical to which they may have been exposed in the laboratory, the employee will be provided with the opportunity to receive an appropriate medical examination.

B. When exposure monitoring reveals an exposure level routinely above the action level (or PEL) for a WISHA regulated substance, medical surveillance will be conducted as required by the particular WISHA standard.

C. Whenever an event takes place in the laboratory, such as a spill, leak, or explosion which results in the likelihood of a hazardous exposure, the affected employee will be provided with the opportunity for medical consultation to determine the need for a medical exam.

II. Type of Medical Attention

All medical examinations and consultations will be performed under the direct supervision of a licensed physician and will be provided without cost to the employee, without loss of pay and at a reasonable time and place. All questions regarding medical consultations and examinations should be directed to the Chemical Hygiene Administrator.

III. Information for the Physician (See Page 6.5)

The following information will be provided to a physician conducting medical consultations and exams:

A. The identity of hazardous chemicals to which the employee may have been exposed.

B. A description of the conditions under which the exposure occurred, including quantitative exposure data, if available.

C. A description of the signs and symptoms of exposure that the employee is experiencing, if any.

IV. Physician's Report (See Page 6.6)

A written opinion from the examining physician for any consultations or exams performed under this

Operating Procedure must include:

A. Any recommendation for further medical follow-up.

B. The results of the medical examination and any associated tests.

C. Any medical condition revealed during the course of the exam which might compromise employee safety during, or as a result of, exposure to hazardous chemicals found in the workplace.

D. A statement that the employee has been informed by the physician of the results of the consultation or medical exam and any medical condition that may require further examination or treatment.

The written opinion should not reveal specific diagnoses unrelated to occupational exposure, except as noted above.

V. Recordkeeping

An accurate record of any medical consultations or medical examinations must be kept by the individual designated by the Chemical Hygiene Officer. Records for each employee must be transferred and made available as specified under WISHA's Access to Employee Exposure and Medical Records requirements (Chapter 296-62-052 WAC).

I. Laboratory Employee Medical Record

Laboratory Employee Medical Record

Employee Name:

Employee ID No.

Date:

Information for the Physician

Complete and provide the following information to the physician:

Identity of the hazardous chemical(s) to which the employee may have been exposed. List chemical(s) below.

Description of the conditions under which exposure occurred, including quantitative exposure data, if applicable.

Description of the signs and symptoms of exposure that the employee is

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experiencing, if any.

Preparer: Date:

Chemical Hygiene Officer: Date:

Laboratory Employee Medical Record

Employee Name:

Employee ID No.

Date:

Physician's Report Checklist

The Physician must complete the following information, either on this form on a separate attachment:

Recommendation for further medical follow-up? _____ No _____ Yes
Please explain.

Results of the medical consultation/examination and associated tests.

Was there any medical condition discovered which may place the employee at increased risk due to the hazardous chemicals found in the laboratory?

_____ Yes _____ No. Please explain.

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The employee has been informed of the results of the medical consultation/examination and any medical condition that may require further examination or treatment.

Physician's Signature: Date:

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Section 7: Standard Operating Procedures for Laboratories

I. Standard Operating Procedures

II. Defining a Hazardous Chemical

III. Developing Standard Operating Procedures

IV. Standard Operating Procedure Form

I. Standard Operating Procedures

Standard operating procedures, containing safety and health considerations, must be developed for operations using *hazardous chemicals*. Hazardous chemicals are defined as chemicals that have statistically significant evidence, based on at least one study conducted in accordance with established scientific principles, that acute or chronic health effects may occur in exposed employees.

II. Defining a Hazardous Chemical

Included in the definition of hazardous chemical is a select group of chemicals that will require additional handling provisions. This group is referred to in the Laboratory Safety Standard as *particularly hazardous substances* and includes chemicals that meet any of the following criteria:

A. High Degree of Acute Toxicity

The Environmental Protection Agency (EPA) has adopted the following criteria to identify acutely toxic chemicals based on data from mammalian testing.

1. Dermal route: the median lethal dose (LD50) is less than or equal to 50 mg/kg.

2. Oral route: the median lethal dose (LD50) is less than or equal to 25 mg/kg.

3. Inhalation route: the median lethal concentration (LC50) is less than or equal to 0.5 mg/1 where time of exposure is any time up to 8 hours.

LD50 is a single dose of a material expected to kill 50% of a group of test animals. LC50 is a calculated concentration of a material in air, exposure to which for a specified length of time is expected to cause death of 50% of a defined experimental animal population.

B. Select Carcinogens

1. Listed as *known to be carcinogens* in the Annual Report on Carcinogens published by the National Toxicology Program (NTP, latest edition).

2. Listed under Group 1 (*carcinogenic to humans*) by the International Agency for Research on Cancer (IARC) Monographs (latest editions).

3. Listed in either Groups 2A or 2B by IARC or under the category *reasonably anticipated to be carcinogens* by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m3; or

After repeated skin application of less than 300 mg/kg of body weight per week; or

After oral dosages of less than 50 mg/kg of body weight per day.

4. Listed as a WISHA regulated carcinogen (see Appendix G).

C. Reproductive Toxins

Known human teratogens from the *Catalog of Teratogenic Agents* by T. H. Shepard are listed below:

aminopterin	androgenic hormones
busulfan	chlorobiphenyls
coumarin anticoagulants	cyclophosphamide
diethylstilbestrol	diphenylhydantoin
etretinate	lithium
mercury, organic	methimazole
methlyaminopterin	penicillamine
retinoic acid, 13-cis-	tetracyclines
(Isotretin and Accutane)	thalidomide
trimethadione	valproic acid

In general, use a Material Safety Data Sheet to assist in determining whether a chemical is hazardous or particularly hazardous.

III. Developing Standard Operating Procedures

Standard Operating Procedures (SOP) are required for chemicals currently in use in the laboratory. When new chemicals are introduced for use, they must be included in an existing SOP or in a new SOP.

Standard Operating Procedures can be written in one or more of the following ways:

A. By process such as distillation or an experiment

B. By each hazardous chemical such as mercury

C. By class of hazardous chemicals such as peroxidizable chemicals, non-halogenated solvents, acids, or aminos.

Elements 1 through 9 must be completed for each process, class of chemicals, or individual chemical. For *particularly hazardous substances*, three additional elements, 10 thru 12, are required to be

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completed. A form entitled *Standard Operating Procedures for Hazardous Chemicals* has been provided with the 12 required elements listed in it. (Refer to the format at the end of Section 7"Standard Operating Procedure, Hazardous Chemicals")

Element 1 Process

If applicable, list the process or type of process that involves the use of hazardous chemicals in this laboratory. This process may be described in general terms, such as *extraction* and *distillation*, or in more detailed terms, such as *spectrophotometer analysis of cholesterol extraction.* If processes do not apply to your laboratory, then proceed to Element 2b.

Element 2 Hazardous Chemicals/Class of Hazardous Chemicals

a. For each process, list the hazardous chemicals and the expected by-products produced; or

b. List the class of chemicals or individual chemicals presently used in your laboratory.

Element 3 Personal Protective Equipment

Discuss the personal protective equipment and hygiene practices used with each process, class of chemicals or individual chemical.

a. Personal protective equipment includes gloves, coats/garments, eye glasses, goggles, face shields, and air purifying respirators. Include the type of gloves needed for each phase of the process. If laboratory coats, eye protection, or respirators are required, indicate when and why.

b. For respirator use, include the type of respirator that should be worn, the kind of cartridges to be used, how often the cartridges should be changed, and how fit testing will be provided.

c. If the processes and/or chemicals used in your laboratory are changing on a daily basis, making it difficult to be specific concerning personal protection, then list the specific references available in your laboratory that contain personal protective equipment information. Employees should then be required to determine the appropriate protective equipment to wear before using any laboratory chemical and/or equipment.

Element 4 Engineering/Ventilation Controls

Please describe engineering controls designed to reduce employee exposures to hazardous chemicals such as ventilation devices, aerosol suppression devices, and safety features on equipment.

Element 5 Special Handling Procedures and Storage Requirements

a. Describe storage requirements for hazardous chemicals in your laboratory. Include restricted access plans, ventilation systems used, special containment devices, etc. (See Appendix A)

b. Describe safe methods of transporting chemicals such as double containment and the use of freight elevators.

Element 6 Spill and Accident Procedures

Indicate how spills or accidental releases should be handled and by whom.

Element 7 Waste Disposal

Describe waste disposal procedures for these chemicals or process products.

Element 8 Special Precautions for Animal Use

Indicate whether any of these chemicals are being administered to animals. Describe safety procedures that apply to working with animals (e.g., aerosol suppression devices, particular animal waste disposal).

Elements 9 through 11 below should be answered only if work involves the use of *particularly hazardous substances.*

Element 9 Approval Required

Indicate whether this chemical or process requires pre-approval as noted in Section 3.

Element 10 Decontamination

Discuss decontamination procedures for equipment and glassware. Include controlled areas such as glove boxes, restricted access hoods, perchloric acid fume hoods, or designated portions of the laboratory.

Element 11 Designated Area

Indicate the designated area for your laboratory. A designated area must be established for work with *particularly hazardous substances*. The entire laboratory, a fume hood, or a portion of the laboratory may be considered as a designated area.

Element 12 Physical and Health Hazards

Note all of the physical and health hazards associated with the chemical. This information can be obtained from the Material Safety Data Sheet.

Standard Operating Procedure

Hazardous Chemicals

1. Process	Used to solubilize or mobilize a soluble substance, distilled, or used as a reagent in a laboratory experiment.
2. Hazardous Chemical	Non-peroxidizable flammables such as methanol, butanol, ethanol, xyiene, toluene, acetonitrile, and acetone.
3. Personal Protective Equipment	Heavy nitrile or silver shield gloves; eye protection such as shielded eyeglasses or goggles and lab coat.
4. Engineering Ventilation Controls	Work in a fume hood when handling flammables.

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5. Special Handling Procedures and Storage Requirements	Store with compatible materials, keep away from poisons, oxidizers, acids, and bases. Store in a flammable cabinet when not in use. Keep away from open flames or other fire sources.
6. Spill and Accident Procedures	For small spills, use absorbent pads or pillows to absorb the spilled substance.
7. Waste Disposal	Double bag any solids resulting from a spill clean-up in high density polyethylene. Other wastes must be placed in a high density polyethylene or glass container with a screw top cap. Label the waste with the words *Hazardous Waste* and a description of the waste.
8. Special Precautions for Animal Use	None.

Standard Operating Procedure

Hazardous Chemicals

1. Process	Etching glass, or used as a reagent in a laboratory experiment.
2. Hazardous Chemical	Hydrofluoric Acid.
3. Personal Protective Equipment	Heavy nitrile or silver shield gloves; eye protection such as shielded eyeglasses or goggles and lab coat.
4. Engineering Ventilation Controls	Work in a fume hood when handling flammables.
5. Special Handling Procedures and Storage Requirements	When moving acids, use a bucket or other secondary containment. Store with compatible materials, keep away from poisons, oxidizers, and bases. Always add strong acids to water when making solutions. Do not store in glass.
6. Spill and Accident Procedures	For small spills, use a dry neutralizing agent. Follow the directions printed on the label of the spill clean-up material.
7. Waste Disposal	Double bag any solids resulting from a spill clean-up in high density polyethylene. Other wastes must be placed in a high density polyethylene or glass container with a screw top cap. Label the waste with the words *Hazardous*

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	Waste and a description of the waste.
8. Special Precautions for Animal Use	None.

Standard Operating Procedure

Hazardous Chemicals

1. Process	Etching metals, neutralizing bases, or used as a reagent in a laboratory experiment.
2. Hazardous Chemical	Acids such as Hydrochloric Acid, Nitric Acid, Sulfuric Acid, and Acetic Acid.
3. Personal Protective Equipment	Heavy nitrile or silver shield gloves; eye protection such as goggles or face shield and lab coat.
4. Engineering Ventilation Controls	Work in a fume hood when handling acids.
5. Special Handling Procedures and Storage Requirements	When moving acids, use a bucket or other secondary containment. store with compatible materials, keep away from poisons, oxidizers and bases. Always add strong acids to water when making solutions.
6. Spill and Accident Procedures	For small spills, use a dry neutralizing agent. Follow the directions printed on the label of the spill clean-up material.
7. Waste Disposal	Double bag any solids resulting from a spill clean-up in high density polyethylene. Other wastes must be placed in glass or a high density polyethylene container with a screw top cap. Do not place Hydrofluoric Acid in glass containers. Label the waste with the words *Hazardous Waste* and a description of the waste.
8. Special Precautions for Animal Use	None.

Standard Operating Procedure

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Hazardous Chemicals

1. Process	Used to solubilize or mobilize a soluble substance, or used as a reagent in a laboratory experiment.
2. Hazardous Chemical	Peroxidizable flammables such as p-Dioxane Ethyl Ether, Tetrahydofuran, and Acetaldehyde.
3. Personal Protective Equipment	Heavy nitrile or silver shield gloves; eye protection such as shielded eyeglasses or goggles and lab coat.
4. Engineering Ventilation Controls	Work in a fume hood when handling flammables.
5. Special Handling Procedures and Storage Requirements	Store with compatible materials; keep away from poisons, oxidizers, acids, and bases. Store in a flammable cabinet when not in use. Keep away from open flames or other fire sources. store in amber glass or a metal can to avoid exposure to light, and purge the head space of a container with an inert gas, such as nitrogen, to avoid exposure to oxygen. Label containers with the date opened, and do not use substances over six months old without testing the substance with a peroxide test strip. Substances must be discarded one year after opening or two years after purchase.
6. Spill and Accident Procedures	For small spills, use absorbent pads or pillows to absorb the spilled substance.
7. Waste Disposal	Double bag any solids resulting from a spill clean-up in high density polyethylene. Other wastes must be placed in an amber high density polyethylene or glass container with a screw top cap. Label the waste with the words, *Hazardous Waste*, a description of the waste, and the date opened.
8. Special Precautions for Animal Use	None.

Standard Operating Procedure

Hazardous Chemicals

1. Process	Elementary mercury is enclosed in devices that

	are used to measure temperature and pressure.
2. Hazardous Chemical	Elemental mercury.
3. Personal Protective Equipment	Gloves. latex or nitrile, eye protection such as eye glasses, and lab coat.
4. Engineering Ventilation Controls	Work in a fume hood when handling elemental mercury.
5. Special Handling Procedures and Storage Requirements	Store with compatible materials; keep away from acids and bases.
6. Spill and Accident Procedures	Small spills, use mercury sponges. For larger spills, use HgX. Follow the directions printed on the label.
7. Waste Disposal	Collect spill waste in a ziploc bag. Other waste must be placed in a sturdy container with a screw top cap. Label the waste container with the words, *Hazardous Waste*, and a description of the waste.
8. Special Precautions for Animal Use	None.

Standard Operating Procedure

Hazardous Chemicals

1. Process	Neutralizing acids or used as a reagent in a laboratory experiment.
2. Hazardous Chemical	Bases, such as Sodium Hydroxide, Potassium Hydroxide, and Ammonium Hydroxide.
3. Personal Protective Equipment	Heavy nitrile or silver shield glover; eye protection such as goggles or face shield and lab coat.
4. Engineering Ventilation Controls	Work in a fume hood when handling bases.
5. Special Handling Procedures and Storage	When moving bases, use a bucket or other secondary containment. store with compatible materials; keep away from poisons, oxidizers, and

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Requirements	acids. Always add strong bases to water when making solutions.
6. Spill and Accident Procedures	For small spills, use a dry neutralizing agent. Follow the directions printed on the label of the spill clean-up material.
7. Waste Disposal	Double bag any solids resulting from a spill clean-up in high density polyethylene. Other wastes must be placed in a glass or high density polyethylene container with a screw top cap. Label the waste with the words, *Hazardous Waste*, and a description of the waste.
8. Special Precautions for Animal Use	None.

Standard Operating Procedure

Hazardous Chemicals

1. Process	Filling gas tanks; dispensing into secondary containers.
2. Hazardous Chemical	Unleaded regular gasoline.
3. Personal Protective Equipment	Splash proof chemical goggles; neoprene or polyethylene gloves; avoid all skin contact, if unavoidable; wear polyethylene chemical resistant clothing.
4. Engineering Ventilation Controls	Use only with adequate ventilation. Use only NIOSH certified respiratory protection. refer to MSDS for acceptable exposure limits.
5. Special Handling Procedures and Storage Requirements	Keep away from heat, sparks, and flame. Keep container tightly closed. Never siphon by mouth or use as a cleaner/degreaser. Store in a well-ventilated area. Use only NEPA Class 1A storage.
6. Spill and Accident Procedures	Prevent ignition; stop leak; ventilate area. Contain spill, use water spray to disperse vapors. Keep upwind of leak. for large spill, use personal protective equipment (see section 3&4). Absorb on inert material, shovel, sweep, or vacuum spill.
7. Waste Disposal	Do not flush to drain/storm sewer. Keep in NEPA Class 1A storage containers for disposal as

	hazardous waste.
8. Special Precautions for Animal Use	Flammable Room/Well-Ventilated Area.
9. Physical and Health Hazards	Primary routes of entry are inhalation, skin and eye. Excessive exposure may cause irritation to eyes, nose, throat, and lungs. May also cause headaches, nausea, and dizziness.

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